Summary of Modeled Impacts on Pecos River Hydrology

Changes to River Flow near Acme from Sumner Dam Reoperations

The alternatives examined under the Carlsbad Water Operations and Conservation EIS prescribe downstream flow targets in the Pecos River at the USGS Near Acme or Below Taiban Gages for the Pecos bluntnose shiner (shiner). These flow targets can be achieved at times by bypassing inflows through Sumner Dam when water is available. Table 1 shows modeled improvements to river flow near Acme for the alternatives examined in this EIS. In the table, No Action represents current operations on the river and the Pre-1991 baseline represents operations when the river was operated solely for the efficiency of the Carlsbad Project. The change in flow exceedance values presented in Table 1 for the No Action Alternative shows the modeled improvement in the percentage of time flows are equaled or exceeded as a result of changing operations from the Pre-1991 baseline to current operations. The remaining columns indicate the modeled increase (or decrease) in the percentage of time flows are equaled or exceeded as a result of changing operations from No Action to one of the listed alternatives (Taiban Constant, Taiban Variable, Critical Habitat, Acme Constant, and Acme Variable).

Table 1. Summary of Modeled Impacts of Reoperation Alternatives on Pecos River Flows Near Acme						
Indicator	No Action Alternative	Taiban Constant Alternative	Taiban Variable Alternative	Acme Constant Alternative	Acme Variable Alternative	Critical Habitat Alternative
Change in percent of time modeled flows of 10 cfs at the Near Acme gage are exceeded	10 percent more frequently than under pre-1991 baseline	3 percent less frequently than under No Action	3 percent less to 4 percent more frequently than under No Action	7 percent more frequently than under No Action	5 percent more frequently than under No Action	2 percent less frequently than under No Action
Change in percent of time modeled flows of 20 cfs at the Near Acme gage are exceeded	19 percent more frequently than under pre-1991 baseline	10 percent less frequently than under No Action	8 to 9 percent less frequently than under No Action.	10 percent more frequently than under No Action	3 percent more frequently than under No Action	6 percent less frequently than under No Action
Change in percent of time modeled flows of 30 cfs at the Near Acme gage are exceeded	24 percent more frequently than under pre-1991 baseline	23 percent less frequently than under No Action	23 percent less frequently than under No Action.	8 percent more frequently than under No Action	0.6 percent more frequently than under No Action	23 percent less frequently than under No Action
Change in frequency of modeled intermittency at the Near Acme gage	0.3 percent less frequently than under pre-1991 baseline	0.04 percent less frequently than under No Action	0.08 to 0.3 percent less frequently than under No Action	0.3 percent less frequently than under No Action	0.3 percent less frequently than under No Action	0.1 percent more frequently than under No Action

Additional or "Net" Depletions as a Result of Bypass Operations

Without the addition of Carlsbad Project Water Acquisition (CPWA), the Pecos River system will incur additional or "net" depletions as a direct result of reoperating Sumner Dam to provide bypasses for the shiner. These net depletions will affect both the Carlsbad Project Supply and flows at the New Mexico-Texas State line. Net depletions mainly arise from the low efficiency of water bypassed for the shiner as opposed to moving the water in a high discharge, high efficiency-block release. Figure 1 illustrates modeled net depletions to the Carlsbad Project Supply as a result of bypass operations without the addition of CPWA to "keep the project whole". Net depletions to flows at the New Mexico-Texas State line as a result of bypass operations, also modeled without the addition of CPWA, are also depicted in Figure 1. The Acme Constant alternative introduces the most net depletions to the Pecos River system because it specifies the largest downstream target flow—35 cfs at Acme year round. The Taiban Constant alternative introduces the least net depletions to the Pecos River system since it specifies the smallest downstream target—35 cfs at Taiban (because Taiban is located upstream of Acme this translates to roughly 2 cfs at Acme in the summer and 20 cfs at Acme in the winter). The other alternatives present flow targets that are intermediate to these two flow target/alternative extremes; subsequently, these alternatives introduce net depletions that are intermediate to those caused by the Acme Constant and Taiban Constant alternatives. Net depletions to flows at the New Mexico-Texas State line are generally half of the those net depletions to the Carlsbad Project for most alternatives with the exceptions of the higher ranges of the Taiban Variable alternative (Taiban Variable—MRS and HRS in the figure), which specify 45 and 55 cfs targets at Taiban during the irrigation season as opposed to Taiban Variable LRS, which specifies 40 cfs at Taiban during the irrigation season. Note the Pre-91 baseline is not shown because all the other alternatives (including No Action) are compared to the Pre-1991 baseline efficiency of the system before it was operated for the shiner in order to determine the additional or "net" depletion caused by Sumner Dam reoperations.

Figure 1. Additional or "Net" Depletions to the Pecos River from Reoperations
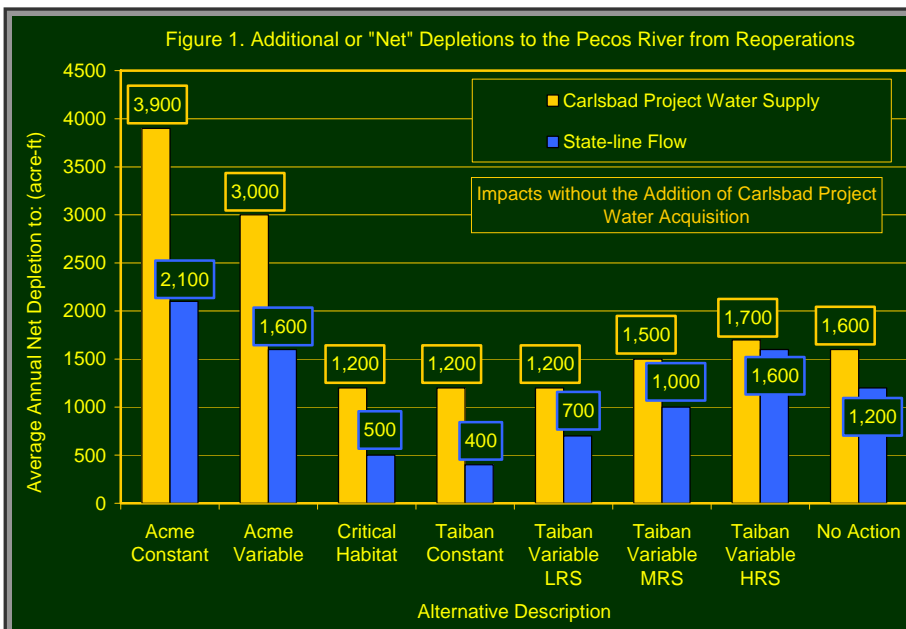
Keeping the Carlsbad Project Whole

In order to keep the Carlsbad Project whole from the impacts of reoperating Sumner Dam for the shiner, Carlsbad Project Water Acquisition (CPWA) is needed to eliminate those net depletions caused by reoperations. CPWA options were evaluated for their effectiveness using surface and groundwater modeling tools. The modeled efficiency of each CPWA option for transmitting water from the water acquisition source to Brantley reservoir was used to evaluate the effectiveness of each offset option. These "CPWA Brantley Transit Efficiencies" are shown in Table 2. CPWA Brantley Transit Efficiencies were

Table 2. CPWA Brantley Transit Efficiencies	
CPWA Option	Brantley Transit Efficiency
Lease or Purchase in FSID	23%
River Pumper Lease or Purchase	55%
Well Field (PVACD Lease or Purchase)	62%
Gravel Pit Pumping	74%
CID Lease, Purchase or Cropping Pattern Change	100%

used to predict the amount of acreage retirement (or acreage put into a cropping pattern program) required to keep the Carlsbad Project whole. Ultimately, these estimated acreages were used to estimate economic impacts to the study area from the retirement or fallowing of lands within the study area to keep the Project whole. The amounts of acreage retirement in each district or in the vicinity of each district to facilitate the elimination of net depletions to the project from the alternatives are shown in Table 3. Note that buying up a portion of CID was considered a valid option for "keeping the Project whole" since the remaining farmers (following Carlsbad Project Water Acquisition) within

Table 3. Retired, Fallowed, or Cropping Pattern Change Acreage Amounts for Sumner Dam Reoperation Alternatives and CPWA Options that Apply					
Alternative	Fort Sumner Irrigation District Lease or Purchase	River Pumper Lease or Purchase	PVACD Lease or Purchase for Well Field	CID Lease or Purchase	CID Cropping Pattern
No Action	3300	1400	1200	800	1600
Taiban Constant	2500	1000	900	600	1200
Taiban Variable	2500 to 3500	1000 to 1500	900 to 1300	600 to 800	1200 to 1700
Acme Constant	8100	3400	3000	1900	3900
Acme Variable	6200	2600	2300	1400	3000
Critical Habitat	2500	1000	900	600	1200

CID will receive the same amount of water as they did before the reoperation of Sumner Dam for the shiner. However, these Project derived CPWA options may affect flows at the State line for better or worse as shown in Table 4.

Table 4. Gains to State Line flows from Project CPWA Options	
Alternative and Project CPWA Amount	Gains to State line Flows from Alternative with CPWA
Taiban Constant with 11,000 AF/year retired or fallowed	3500
Acme Constant with 11,000 AF/year retired or fallowed	3000
Taiban Constant with 5,200 AF/year from crop subsidy	-800
Acme Constant with 5,200 AF/year from crop subsidy	-1100
Taiban Constant with 14,000 AF/year from crop subsidy	2600
Acme Constant with 14,000 AF/year from crop subsidy	2300

Additional Water Needed (AWN) and Additional Water Acquisition (AWA)

Since bypass supplies are limited and cannot always be relied upon to achieve the downstream flow targets specified by the alternatives, all of the alternatives have additional water needs (AWN). These water needs would either be fulfilled by diverting CID's supply into a fish conservation pool (FCP) or by additional water acquisition used directly for the shiner (AWA).

AWN is calculated by post-processing model output to determine the amount of additional water needed at Sumner Dam to achieve all of the targets. Average annual AWN for each alternative is shown in Figure 2. As part of the analysis of CPWA and AWA options in this NEPA process, annual amounts of available AWA were estimated. These annual estimates in some cases are significantly less than the AWN required by certain alternatives. For this reason, the limited (estimated) amounts of AWA were modeled to show the relative improvement to flow frequency at Taiban and Acme if all of the AWN required could not be obtained. Table 5 shows the relative improvement and detriments to intermittency and flow frequency for the AWA options modeled for this NEPA process. Note that although modeled flows are improved for AWA options coupled

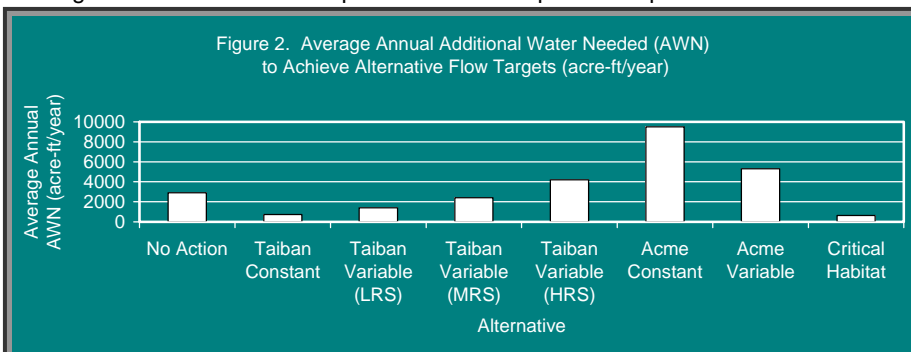| Table 5. Improvements and Detriments to Intermittency and Flow Frequency at Acme from Modeling of Limited AWA Amounts			
AWA Option	Range[1] of Increase in Intermittency (days/year) from AWA	Average days per year that the modeled flow at the Acme Gage was increased[2]	Average days per year that the modeled flow at the Taiban Gage was increased[3]
9,040 AF/year from FSID	4.9 to 5.6	46	-9
4,300 AF/year from PDL	-0.3 to 0.2	11	-1
1,800 AF/year from Well Field	-0.3 to 0	2	0
300 AF/year from Gravel Pit	-0.3 to 0	0	0

[1]Range of Impacts Modeled with both Taiban Constant and Acme Constant alternatives.
[2]For the Acme Constant Alternative only.
[3]For the Taiban Constant Alternative only.

with the Acme Constant alternative; for the Taiban Constant alternative, modeled flows decrease from AWA activities. Changes in modeled intermittency showed slight improvements to detriments (such as AWA from FSID) for AWA activities coupled with either alternative.

Figure 2. Average Annual Additional Water Needed (AWN) to Achieve Alternative Flow Targets (acre-ft/year)

Additional Information
Additional information concerning the Carlsbad Project DEIS can be found on the Bureau of Reclamation's Project Website at:
http://www.usbr.gov/uc/albuq/library/eis/carlsbad/carlsbad.html